

PATHWAYS

Vol. II

AUGUST 1980

No. 3

ABOUT THIS ISSUE

Dear Readers,

When Jose Paul wrote his second article on Behavioural Objectives for this issue, I asked him, "A classroom teacher has no time for planning lessons in this elaborate fashion, starting from objectives ! What good is this theory ? How will it help a teacher ?"

In response to my question, he persuaded me to work out a unit with him-starting from objectives. The result of our efforts-The Indus Valley Civilisation-appears in this issue. I will confess straightaway that neither of us has a background of Social Studies; which only made our task more interesting ! We hope some of you will write and tell us your reactions after trying the lesson out in class. The exercise made us more aware that we, as teachers, must at least *occasionally* analyse our teaching practices; see if we achieve more than a mere transference of facts; see if we train our pupils in skills which help them to learn for themselves.

Saroja Srinivasan writes about 'Evaluation in Environmental Studies', a problem that has worried many creative teachers who have been trying to put in that extra 'something special' into their lessons, linking them with the environment. For those who like to work with their hands the Papier Mache Relief Map and the Improvisation of Musical Instruments provides something interesting. Mary Mathews, a Biology teacher of many years standing, writes about ideas she has tried out in the Middle School, to make Biology 'really exciting and not just diagrams, charts and a few unpronounceable words'.

Saroja Sundararajan's article makes an abstract algebraic process, factorisation, come alive with the help of simple paper cut-outs. Mrs. Meera Parasnis writes again; this time about a practical demonstration of household electrical circuits, improvising with easily available material. From personal experience, I know that the experiments suggested in her books are an excellent way of letting children perform 'practicals' with a minimum of expenditure.

Happy reading !

Gayatri Moorthy

Setting Behavioural Objectives - II

— Jose Paul

In the first article of this series, I attempted to define a well-stated behavioural objective. We found that it defined student behaviour arising as a result of a learning experience; spelt out what the teacher needed to observe and measure; specified the standard of performance required of the student and ensured that this was both attainable and measurable.

In the broadest sense, the goals of education are to help the student to know and think, to feel and to act; in more technical terms these refer to the cognitive, the affective and the psychomotor domains of learning. The objectives of this article are :

- * to enable the reader to recognise and classify educational objectives into the cognitive, affective and psychomotor domains,

- * to enable the reader to spell out clearly behavioural objectives in these three domains, and

- * to enable to reader to appreciate the necessity of providing the student with learning experiences in all three domains.

Given below are three sets of educational objectives. On reading through them you might be able to find out the common element in the objectives of each set.

Set A : i. The child should be able to recognise the action of force in at least five examples in and around the school.

ii. The child will be able to group together living and non-living things by observing their characteristics.

iii. The child will be able to estimate the order of magnitude of a series of fractions.

iv. The child will be able to summarise the given article of two pages into half its size in four minutes.

v. The child will be able to find the fallacies in an argument.

vi. The child will be able to illustrate the function of the heart with the help of a diagram.

Set B : i. The child will voluntarily spend some of his leisure time in the library reading through reference books on wild life.

ii. The child will express happiness in reciting the poem 'Funny Man'.

iii. The child will study on his own, chapters of the mathematics text-book before they are taught by the teacher or assigned as a task.

iv. The child will exhibit leadership and responsibility whenever the teacher is absent from the class.

v. The child will be able to display a sense of humour, even when others tease him.

vi. The child will persist in his work in spite of distractions.

Set C : i. The child will be able to play three simple tunes on the guitar after taking lessons for one month.

ii. The child will be able to type at the speed of 40 w. p. m for a period of fifteen minutes and not make more than three mistakes.

iii. The child will be able to use a screw driver and a pair of pliers with ease to repair his toy cars.

iv. The child will be able to ride a bicycle at a speed of twenty km. p. h on the highway and obey all traffic rules and signals.

v. The child will be able to swim the entire length of the pool, doing a breast stroke, in three minutes.

vi. The child will be able to reproduce three pages of English prose in a legible and neat handwriting within half an hour.

No doubt you would have found out by now that the objectives of Set A deal with the acquisition

tion of knowledge and thinking on the part of the students. Recognition of the action of force in new situations involves use of previously obtained knowledge; the grouping together of living and non-living things involves discriminating between their characteristics. Estimating the size of fractions, summarising a given passage and explaining the action of the heart are all forms of intellectual activities. Educational activities of this type, starting from recall of simple facts from memory, understanding of concepts and relationships application of knowledge in unfamiliar situations, analysis, synthesis and evaluation belong to the cognitive domain. Activities that require a student to recall, define, distinguish, recognise, identify, categorise, classify, translate or re-state, re-phrase, illustrate, interpret re-arrange or demonstrate belong to this category. Other words commonly used are : estimate, infer, conclude, predict, determine, extend, expand, to fill in, apply, generalise, relate, develop, organise, re-structure, detect, deduce, contrast, modify tell, produce, devise, synthesise, formulate, judge, assess, evaluate, compare, contrast.

The objectives of Set B may perhaps seem somewhat more difficult to achieve, and yet they are no less important than those of Set A. They deal with the exhibition of the child's feelings (happiness), his attitudes (interest in reading, in studies, displaying a sense of humour) and his sense of values (leadership, responsibility, determination to work hard). Objectives such as these which deal with the expression of feelings, attitudes and values belong to the affective domain. The process of education cannot be said to end with the acquisition of knowledge or the training of the mind to think, for unless a child 'feels' he will not act. Intellectual understanding of the causes of poverty will not move him to respond to appeals for help from the less fortunate. Education in the affective domain is the education of the heart which helps to mould the person as a whole.

The above two domains are to some extent inter-dependent. Learning the basic operations of mathematics belongs no doubt to the cognitive

domain, but enjoying the solving of mathematical problems or appreciating mathematics as a favourite subject lies in the affective domain. A child who enjoys mathematics, willingly spends more time at it and as a result his abilities (cognitive) also improve. A teacher who takes the trouble to inculcate in the student positive attitudes towards himself, other people, things and events is educating both the mind and the heart of the child.

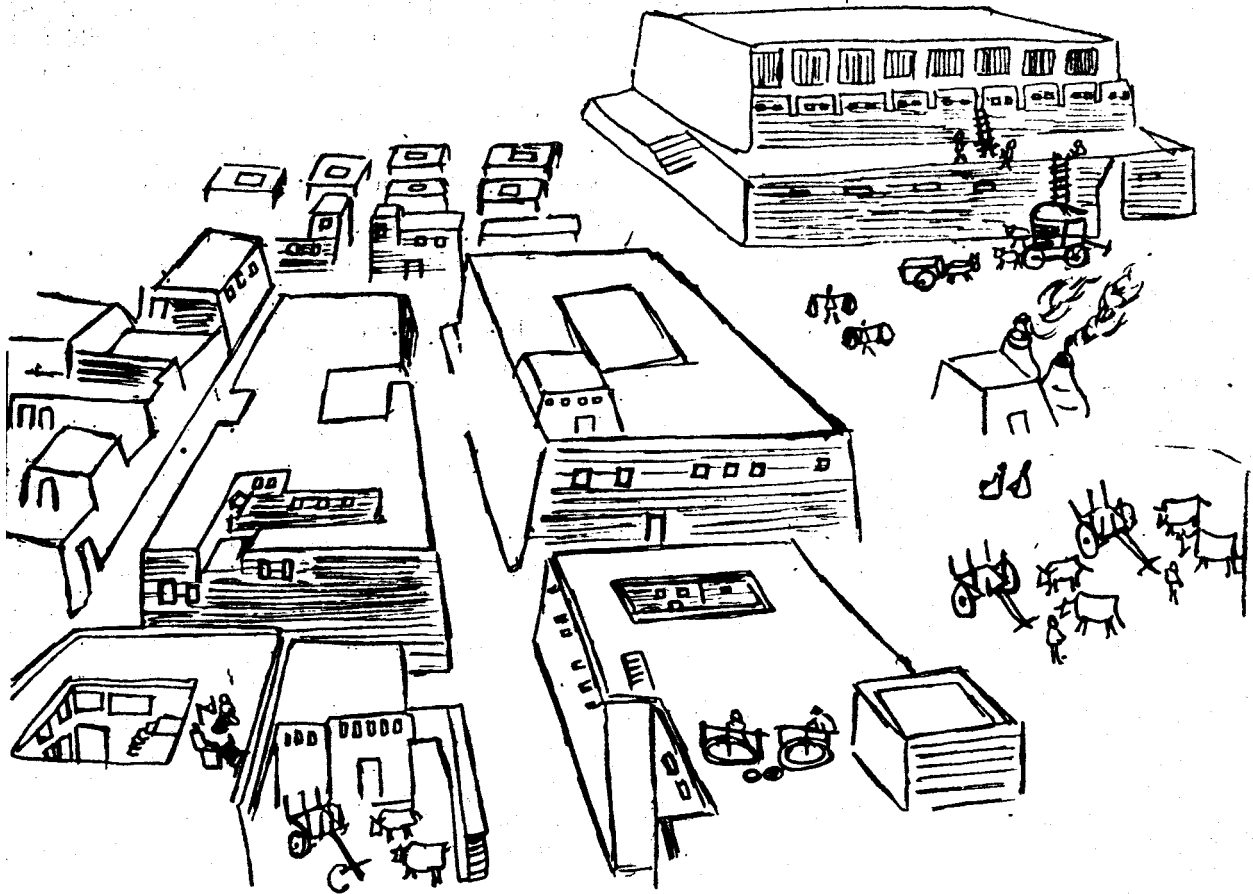
Activities referred to in Set C are all examples of 'action' - the use of the body. Learning or the acquisition of skills in this, the psychomotor domain, involves in the simplest form imitation and repetitive activity. It progresses through manipulation, articulation and eventually leads to habit formation. In all these activities we find two components interlinked-the mind and the body. In the early stages, the mind and the body have to work in coordination; at a later stage the behaviour becomes a habit and the role of the mind is negligible. A good swimmer swims effortlessly without thinking about it.

Actually all three domains are linked in such a way that a change of behaviour in any one is bound to affect the others as well. When a child learns to play the guitar he has to start with learning to recognise notes printed on the page and linking them with the position of his hands on the strings. With practise, this coordination between the mind and the hand becomes easier and he develops an interest in the music. If suitably encouraged, he willingly spends more time on practice and is motivated to learn faster. This process could work in the reverse direction as well. If the student's first attempts to learn different chords and other details prove too difficult he may be discouraged and lose interest. The wise music teacher knows this instinctively and through experience and ensures that the child enjoys the lesson while also acquiring technical skill.

Teaching being an 'art', there is no doubt that a 'born teacher' practises much of his art instinctively. Yet, there is certainly a need for

(contd. on page 15)

The Indus Valley Civilization



This unit provides an opportunity for students to learn about life in some of the world's early cities—located in the Indus River valley. Let us first set some objectives (behavioural goals) for the student. During his participation in the learning experiences suggested the student should be able to show

- * some understanding of why cities began to develop
- * a deeper understanding of ways in which the following ideas helped people to live together successfully in early cities—division of labour, using natural resources, tools, exchange, rules and government, co-operation.
- * a better understanding of time and chronology, as evidenced by his ability to place events correctly on a time line.
- * an increasing ability to interpret pictures and maps and to use a globe.
- * growth in his ability to locate information
- * an increasing ability to communicate his ideas effectively
- * an improvement in his ability to use various thinking skills.
- * an increasing desire to discover for himself
- * willingness and ability to work with others on class projects

Some Resources which might be Used :

Photographs of The Great Bath

General View Of Houses and Lane

Map showing location of Harappan Culture and Mesopotamian Civilization

Drawing of Pattery of Harrapan Culture

(All the above are available in The Story of Civilization, Volume I, published by the N. C. E. R. T)

Models of Harappan Seals and Clay Toys—available from the National Museum

A Map of the Indian Sub-continent

Encyclopaediae and other reference books for students.

More interesting photographs and drawings could be located in other history textbooks and books on architecture.

The National Museum has actual archaeological 'finds' on display.

The EPG has a set of one hundred coloured slides with an accompanying taped commentary on 'The Indus Valley Civilization' which may be borrowed by schools in Delhi.

Given below are some possible learning experiences which the teacher might like to try out in class. It is presumed that the students will be able to read their textbook on their own, thus saving time for the initiation of 'thinking' activities.

Suggested Learning Experiences :

1. Locate the river Indus on the map of the Indian sub-continent. By placing over it a paper cut-out to show the extent of the Indus Valley Civilization, find out which parts of it lay in India and which in Pakistan. Locate important modern cities which exist today in the same region.

2. Look at the picture of the Great Bath (p. 28, The Story of Civilization, Volume I, NCERT). Study it carefully and write down three or four facts that you can find out about the Great Bath:

(Steps lead down to the Bath; it must have been quite deep; in the foreground there appears to be a drain at ground level; the entire structure was located on a raised area)

3. What conclusion can be drawn from a study of the picture showing the houses and lane excavated at Kalibangan? (p. 20 of the same text).

(Houses are laid out in rows on either side of a narrow street; flat roofs are seen on some of them; their height was perhaps greater than that of a man—compare with man standing on street; perhaps they had more than one storey; the walls are made of bricks.)

4. If possible watch a potter at work at his wheel. Compare the shape of some of his products with the Harappan jar shown in the figure. (p. 30) What else can you say about the pottery produced in those days?

(Such shapes were possible because they must have used a potter's wheel; elaborate decorations indicate knowledge and use of some dyes—perhaps of vegetable origin—obviously the pottery was baked.)

5. Identify some of the animals shown on the seals.

Some of the seals have inscriptions on them, which lead archaeologists to believe that the Harappan Civilization used a script of its own. Who do you think would have had the ability to decipher these scripts? In what ways do you think this spoken and written language helped them to carry on trade? to make and carry out laws?

6. What do the toys tell you about the kinds of animals that may have been raised? about the transport system?

7. Think of some of the toys you have played with. Suppose that thousands of years from now, archaeologists found these toys. What could they learn about our way of life by studying these toys?

(An exercise such as this may help students to realize how such seemingly insignificant articles such as toys can help archaeologists make important discoveries about an ancient civilization)

8. How do you suppose the artist who drew the picture in this article found out what the city of Mohenjo-Daro may have looked like?

Division of Labour :

9. Farmers in the Indus Valley were able to produce more food than they needed for themselves and their families. If they had not been able to do this, do you think Mohenjo - Daro and other cities would have grown up in the Indus Valley? Why do you think this?

10 What kinds of work do you think the people in Mohenjo-Daro did ?

a. What kinds of workers in the city might have helped people meet their need for food ? for clothing ? for shelter ?

b. What other kinds of workers might have helped to make the city a good place for people to live ?

c. Do you think there were as many different kinds of workers in Mohenjo-Daro as there are in our community today ? Why do you think this ?

11. Do you feel that the people in Mohenjo-Daro worked so hard that they found little time for leisure and recreation ? Why ?

Using Natural Resources :

12. People made use of wood, metal and stone in those days. Can you make up lists of articles which they might have made from these materials ? Where do you think they obtained the materials ?

(Wood-carts, boats, furniture; Metal-tools, jewelry, figurines; Stone-weights; toys, figurines, knife blades.

They probably got wood from the forests of the Indus River Valley and in the highlands to the East and the North. Some metals were probably mined nearby. Other metalware may have been obtained by trading)

13. What natural resources would the people have used in building their homes ?

(Clay, soil and water. Wood from trees must have been used as fuel for the ovens in which the bricks were baked.)

14. To what uses could they put the River Indus ?

(Apart from providing a link with the rest of the world, boating as recreation, fish as food are some possibilities.)

15. What if any, similarities can you see between the effects of the floods on the life of people in the Indus Valley civilization and the effects of the monsoons in India ?

Tools :

16. What kind of tools do you think they would have used for making cloth, fashioning articles

from metal, raising crops, threshing grain, catching fish, to build their homes ? Observe some of these activities today and try to find out if the processes and tools used have changed substantially in recent times.

Exchange :

17. Find the city of Ur (Map on P. 31 of The Story of Civilization, Volume I). People in Mohenjo-Daro probably traded with people in Ur and other cities in Mesopotamia. How do you think men and materials reached these places ? On the globe try to trace out routes they may have followed.

18. Do you think that the division of labour in those times, helped the people to carry on trade ?

Rules and Government, Co-operation :

19. What kind of laws do you think the people of Mohenjo-Daro needed ? Why ?

20. How might a lack of cooperation among the people caused their community to grow weak ?

Adding to the Time Line :

21. Show the approximate dates of the following Civilizations on the time line.

Egypt (3100 B.C-300B.C), Mesopotamia (3500 B.C-500 B.C); Indus Valley (2500 B. C-1500 B. C).

22 Construct a model of Mohenjo-daro showing the streets, buildings and granary. Since the buildings were rectangular and had few windows, you may be able to use cardboard boxes. The drawing in this article and illustrations from books in the library will help you design your model.

Gayatri Moorthy
Jose Paul

To work, alone, you are entitled, never to its fruit. Neither let your motive be the fruit of action, nor let your attachment be to non-action.

The Bhagavad Gita

(All the above are available in The Story of Civilization, Volume I, published by the N. C. E. R. T)

Models of Harappan Seals and Clay Toys—available from the National Museum

A Map of the Indian Sub-continent

Encyclopaediae and other reference books for students.

More interesting photographs and drawings could be located in other history textbooks and books on architecture.

The National Museum has actual archaeological 'finds' on display.

The EPG has a set of one hundred coloured slides with an accompanying taped commentary on 'The Indus Valley Civilization' which may be borrowed by schools in Delhi.

Given below are some possible learning experiences which the teacher might like to try out in class. It is presumed that the students will be able to read their textbook on their own, thus saving time for the initiation of 'thinking' activities.

Suggested Learning Experiences :

1. Locate the river Indus on the map of the Indian sub-continent. By placing over it a paper cut-out to show the extent of the Indus Valley Civilization, find out which parts of it lay in India and which in Pakistan. Locate important modern cities which exist today in the same region.

2. Look at the picture of the Great Bath (p. 28, The Story of Civilization, Volume I, NCERT). Study it carefully and write down three or four facts that you can find out about the Great Bath:

(Steps lead down to the Bath; it must have been quite deep; in the foreground there appears to be a drain at ground level; the entire structure was located on a raised area)

3. What conclusion can be drawn from a study of the picture showing the houses and lane excavated at Kalibangan? (p. 20 of the same text).

(Houses are laid out in rows on either side of a narrow street; flat roofs are seen on some of them; their height was perhaps greater than that of a man—compare with man standing on street; perhaps they had more than one storey; the walls are made of bricks.)

4. If possible watch a potter at work at his wheel. Compare the shape of some of his products with the Harappan jar shown in the figure. (p. 30) What else can you say about the pottery produced in those days?

(Such shapes were possible because they must have used a potter's wheel; elaborate decorations indicate knowledge and use of some dyes—perhaps of vegetable origin—obviously the pottery was baked.)

5. Identify some of the animals shown on the seals.

Some of the seals have inscriptions on them, which lead archaeologists to believe that the Harappan Civilization used a script of its own. Who do you think would have had the ability to decipher these scripts? In what ways do you think this spoken and written language helped them to carry on trade? to make and carry out laws?

6. What do the toys tell you about the kinds of animals that may have been raised? about the transport system?

7. Think of some of the toys you have played with. Suppose that thousands of years from now, archaeologists found these toys. What could they learn about our way of life by studying these toys?

(An exercise such as this may help students to realize how such seemingly insignificant articles such as toys can help archaeologists make important discoveries about an ancient civilization)

8. How do you suppose the artist who drew the picture in this article found out what the city of Mohenjo-Daro may have looked like?

Division of Labour :

9. Farmers in the Indus Valley were able to produce more food than they needed for themselves and their families. If they had not been able to do this, do you think Mohenjo - Daro and other cities would have grown up in the Indus Valley? Why do you think this?

Evaluation in Environmental Studies

—Saroja Srinivasan

An argument frequently used against the introduction of Environmental Studies in schools is that we cannot tangibly test and evaluate *the skills* which we seek to develop in the students. Many teachers feel more secure in the traditional, content-oriented education in which the facts taught to the children can be easily tested. This security is denied to them in Environmental Studies where they are continually experimenting and working with new methods of teaching. It is time to pay attention to what educational psychologists have stated that children learn through their own intrinsic motivation, and to seek new ways of testing the *skills* of the students.

There is scope for extensive research in this field, which may in itself prove a blessing in disguise, permitting teachers to try out new testing techniques and also find out the feasibility of using them. We need to take this up as a challenge and as an opportunity for collective work by teachers.

Before we think of testing, it is most important to clarify in our own minds what exactly we are trying to test ; in other words our objectives or goals need to be specified. Sometimes these have to split up into a number of simpler objectives so that the mastery of a particular skill can be broken up into a number of simpler objectives so that the mastery of a particular skill can be broken up into its components and tested at each step. Let us consider a concrete example — the skill of drawing maps. This could involve various techniques :-

- * learning about the directional points and being able to form mental directional maps.
- * learning to reduce measurements to scale and to find out actual measurements from a given scale.
- * being able to draw conventional symbols to represent actual objects and being able to visualise actual objects by looking at a key.
- * being able to orientate and make use of a given map.
- * learning to draw an actual map using symbols and scale measurements.

No doubt we might think that we have broken up the skill into its components, but consider again what learning about directions means to *a child*. It involves the following progressional stages :

- * learning the names of the eight cardinal points:
- * learning to use the sun to find directions.
- * learning to use the compass-understanding that the needle always points to the North.
- * being able to use the compass to name objects in a given direction.
- * learning to name the directions in which certain objects or places exist.
- * using the compass as a guide during actual field work.
- * being able to use the compass mentally as a guide.
- * forming mental maps of places and objects; being able to find their relative positions or directions.

- * forming mental maps of areas near the school.
- * forming mental maps of areas away from school.
- * forming mental maps of areas in the city, leading upto
- * forming mental maps of areas near the city, of states in the country, of countries in the world.

Each of the above could be an objective for the devising of a test or a series of tests.

One of the most obvious methods of testing that one can think of is to ask child to actually demonstrate the skill he has acquired-use the compass to carry out certain exercises and permit the teacher to gauge how adept he is at it. There are two pitfalls to be guarded against in this method. Often the child's overall outward appearance or behaviour may subtly affect the teacher's judgement- a well-behaved, well-dressed child might appear to be more intelligent than he or she actually is. Secondly, the teacher, albeit unconsciously, may provide the child with clues as to what the correct answer is. It may be a posture, an inflection in her voice or a look which tells the clever child exactly what he has to do.

If one prefers to devise a test of the more formal variety, it could have two components- testing on memory and recall and testing of the concepts learnt. Wherever possible it better to test the application of the knowledge gained. For example, when children have learned about methods of separation of mixtures, we could ask them to separate simple mixtures like salt and chalk, sugar and sand or even oil and water. This would avoid a question like 'How can soluble and insoluble impurities be separated ?

We must decide what form the test is going to take-oral or written, how frequently tests will be used, what questions will be asked; prepare a check list which will state exactly what we expect in the answer and how it will be marked. This check list prevents any subjectivity from creeping into our evaluation of the child's work; he is marked for what he has actually done. Care must be taken to see that questions are clearly stated and unambiguous; a good teacher often works out the whole test herself before administering it. We should also attempt to remove any fear or panic in the child which would obviously affect his/her performance in the test. One way is to give them without warning as part of normal class routine or perhaps without even calling it a test. Periodic and continuous testing gives us a better idea of the child's understanding and permits us to monitor his progress. It is more important to compare his results with his own previous performance than with that of the other children.

All this might seem, to the experienced teacher a statement of the obvious, so let us try now to work out a few examples, putting into practice what has been said earlier.

Some of the skills which can be tested are :

- * the taking of accurate measurements.
- * interpretation of graphs.
- * representation of given data in graphical form.
- * classifying given objects according to the child's own criteria, or according to given criteria.
- * being able to isolate a problem and devise an experiment to test a hypothesis.
- * constructing questionnaires for the conducting of an interview.
- * interviewing and recording the information gathered.
- * interpreting given maps
- * constructing maps

Four examples are given below. In each the various stages in formulating the test are spelt out. Perhaps many teachers are already doing this without actually writing down these steps. I feel that to do this as an exercise helps us to improve our own testing techniques.

Example 1 :

Objective : To test the child's ability to draw a map with all the pre-requisites—title, directional points, scale, key.

How will the test be administered : The child will draw a map of his classroom after taking suitable measurements.

The Test : Draw a plan of your classroom.

Measure the room and reduce it to scale.

Show the position of the teacher's table and chair.

Mark your seat in the classroom.

Checklist : If all the conditions listed below are fulfilled, the total ten marks will be awarded.

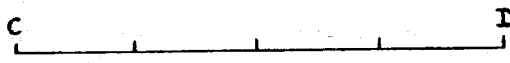
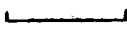
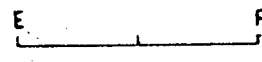
- | | |
|--|---------|
| i. If the map has a title and the date | 1 mark |
| ii. For correct directional points | 1 mark |
| iii. For correct indication of scale measurement | 1 mark |
| iv. For correct representation of symbols | 1 mark |
| v. If all figures are two-dimensional and there is no three-dimensional representation | 1 mark |
| iv. For taking correct measurements and reducing it to scale | 2 marks |
| vii. Correct placement of teacher's table and chair | 1 mark |
| viii. For correct indication of his own seat | 1 mark |
| xi. Neatness | 1 mark |

Example 2 :

Objective : To test the child's ability to interpret scale measurements.

Administration : The child will write the answers in spaces provided in the paper.

The Test :

	 = 5 km.
	 = 10 km
	 = 100 km
	 = 3 km.

Complete the following sentences :

- i. It is further from-----to-----than it is from C to D.
- ii. It is further from A to B than it is from-----to-----.
- iii. The shortest distance indicated is from-----to-----, which is -----km.
- iv. The longest distance indicated is from-----to-----, -----km.

Checklist :

Question i	1 mark
Question ii	1 mark
Question iii	2 mark (1 + 1 for km)
Question iv	2 mark (1 + 1 for km)

Total 6 marks

Example 3 :

Objective : To test the child's ability to draw bar graphs

Administration : The child will be provided with data and asked to represent it graphically.

The Test : A survey of the residents of R. K. Puram was done to find out which states they belonged to. The results were as follows :

House No.	Occupant's Name	State to which he Belongs
No. 120	Mr. Thomas	Kerala
No. 121	Mr. Sharma	Punjab
No. 122	Mr. Aggarwal	U.P.
No. 123	Mr. Dinanath	U.P.
No. 124	Mr. Krishnan	Tamil Nadu
No. 140	Mr. Gulati	Punjab

Draw a bar line graph to show how many families of each state lives in this street.

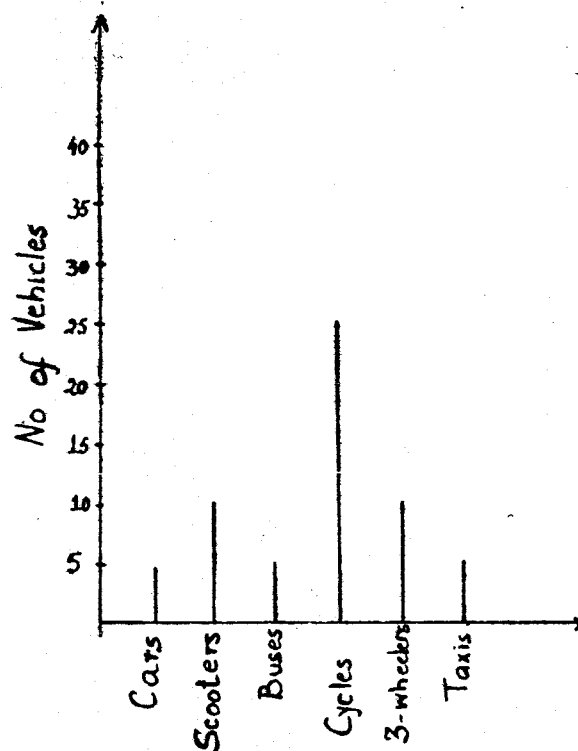
Checklist :	Title	1 mark
Correct naming of x and y axis		1 mark
Correct numbering of axis		1 mark
Correct representation of data		2 mark
Total		5 marks

Example 4 :

Objective : To test the child's ability to interpret a given graph.

Administration : The child will be asked to write answers to questions based on a given graph.

The Test : The following graph shows the figures collected during a traffic survey carried out on October 10th, 1978 at the Tamil Sangam Marg during an interval of 15 minutes from 8.30 a.m to 8.45 a.m



Study the graph and indicate whether the following statements are true or false. In this area

1. More people have cycles than cars or scooters
2. More people use taxis than three-wheelers
3. People do not buy a lot of petrol
4. Not many houses have garages.
5. The same number of cars, taxis and scooters have passed on the road.

Checklist : Each correctly answered question deserves one mark. Total 5 marks.

During the course of their investigations children generally acquire plenty of information. They could learn about how houses are constructed, how plants grow and produce seeds or how cloth is made from its raw materials. If teachers could incorporate part of the given syllabus into Environmental Studies investigations then the content of these lessons is also covered. This is especially true in the chapters of Science dealing with Air, Weather, Forms of Energy, Animal and Plant Life. In Social Studies portions of Civics, general Geography and the history or culture of some states of India can form part of such investigations. Often the factual knowledge acquired far exceeds what the book can give. Obviously, this can be tested as part of the regular examination, leaving some time for testing of the skills as well.

(Mrs. Sareja Srinivasan of Ramjas School, R. K. Puram, Sector IV is well-known to many teachers of Delhi who have attended courses on Environmental Studies conducted either at the Ramjas Teachers' Centre or by the EPG. Keenly interested in trying out new ideas herself, she attempts to analyse whether they are educationally useful in the classroom. She has returned recently after pursuing a course of higher studies in Environmental Education at the Gwent College of Education, Wales.)

A PAPIER MACHE RELIEF MAP

Papier Mache is easily made by the following method and is simple to use. Get some sheets of old newspaper and tear these into very small pieces and soak them in a bucket full of hot water. After you are sure that the paper is well soaked and quite soft, rub this against a wire mesh strainer to shred the paper into the tiniest fragments. The finer you can make the bits, the smoother will be the texture of the papier mache. Strain off as much water as possible and squeeze the pulp in your hands. You can even pour this on to a piece of silk or fine muslin and squeeze that to remove more water.

Next add some white glue to the wet paste to hold the particles together. Knead the mixture well to ensure that the glue is well mixed into it. Ordinary, thick; homemade atta paste is also suitable for this purpose. Should the mixture stick to your fingers, it is too soft and needs more squeezing to get the water out. Try putting your fingers in the pulp and if they leave clean holes, the pulp is ready for use. If however cracks appear at the edges, the mixture may be too dry and a little more water may be needed. Ideal papier mache should have the consistency of soft clay. It can provide a fine medium for the making of colourful relief maps which are fairly simple to construct.

First of all select a piece of smooth wood of the required size which will serve as the base for the map. Nail (or use Quickfix) strips of plywood of suitable height to form a frame around the wooden base.....it has to be converted into a very shallow tray.

Pencil or crayon the outline of the map on the wooden base. Prepare papier mache as described earlier and apply the pulp over the surface of the wood. Layer after layer may be added up to the required height. Always wait for one layer to dry before applying another. Mountain ranges

of varying heights, plateaux, valleys can all be constructed. Younger children will perhaps not be able to work to a scale but may certainly show up differences between say the Vindhya and the Himalayas. Older students might spend some time in calculating appropriate measurements based on the actual heights of relief features above sea level. Models of houses, trees, animals and people lend realism for junior classes. Seniors may prefer to use symbols and provide a key.

When the papier mache is fully dry, it may be painted over using poster colours or powder paints mixed in gum. A covering coat of colourless lacquer will help to preserve the gloss of the paint. Should any part of the map come apart from the base, it can be gummed down securely and a weight placed on it until it is firmly fixed.

A project of this nature undertaken jointly by a group of students provides many valuable experiences in working together.

YOUR ATTENTION PLEASE

PATHWAYS is issued four times a year in February, April, August and November. The annual subscription for readers in Delhi is Rs 5/- and Rs. 6/- for other. Subscriptions may be sent by **Money Order** to the Educational Planning Group, 4 Raj Niwas Marg, Delhi-110 054. Readers subscribing in 1980 will receive issues for April, August, November 1980 and February 1981. They will have to renew their subscriptions in February 1981.

Contributions from teachers describing new ideas that they have tried out in their classrooms, their problems and experiences are welcome. These should reach Mrs. Gayatri Moorthy at the above address **not later than the 20th of the preceding month.**

Letters From Our Readers

Three cheers for 'PATHWAYS' for bringing into our classrooms so many bright, lively and interesting ideas that work. Also articles such as Jose Paul's 'Setting Behavioural Objectives' (April 1980 issue) make us sit down a while and think 'Why are we teaching at all?'

I was very moved by the second last paragraph of Sandhya Patke's report on her activities with her class on 'Our Industries' (April 1980 issue), the telling statement there being "owing to the lack of time and the nearness of examinations" she could not arrange visits for the children to the large and small-scale industries even within the neighbourhood. What an immense loss in 'real' experience for the children—all the sounds and smells that they would have been exposed to, all the talk and writing and thinking that such a visit would have engendered have been lost because of the great axe of examinations which hung over Class IV.

I think it is time that examinations, as we know them, be put in the dock. It would take very little time to assign them 'life imprisonment'. My main charge against examinations is this—if 'education' is about creating an environment concerned with the development of attitudes such as objectivity, self-sufficiency, flexibility, inventiveness and resourcefulness, then our examination-oriented system totally subverts this aim. I remember entering a staffroom last March after a soul-destroying three hour invigilation duty, only to be met by an elated Geography teacher who was overjoyed by the fact that a few of her pupils had been able to mark on the world map even Lake Chilka (Geography Question Paper-Board Examination for the Xth). My own answer to that is aptly summed up by this child's comment—"I want education to be something I can enjoy; a pleasure; a pleasant thing—not a burden; a tiresome collection of dreary facts that I have to learn like a parrot." (April 1980 issue-PATHWAYS).

Meera Govil

The concept of 'teaching' in schools has been going through a series of changes over the past decade or more. It has come to be recognised more and more that teaching aims at obtaining a 'measurable response' from the pupils in a 'compartmentalised' manner. No doubt, in an age of specialisation this compartmentalisation of activities and responses is inevitable; but the totality of the 'art of teaching', of making the inter-action between the teacher and the taught a facile and enlivening experience should not be overlooked.

Teaching should be a blend of the following components : factual, informative, innovative, interpretative, inter-actional.

No teacher can be successful without knowing his subject well. There is no substitute for the teacher's own knowledge or the homework required in preparation for a teaching session. A text-book is no doubt, a condensation of the subject written within the framework of the syllabus; related information from other books, gleanings from original references, magazines and additional facts provide useful, informative material which not only buttresses the textbook lessons but also makes them more interesting. An application of a theory leaves the pupil with a clearer impression, just as an example highlights a generalisation.

A teacher is like an artist at work; he senses the mood of his pupils, their inclinations, their absorption. He tries to hold them in a spell during his lessons. To do so he has to devise his own methods of teaching, improvise according to the needs of the moment, experiment with techniques where required. When lessons are couched in language which is difficult for the pupils, the teacher becomes an interpreter. He draws on his own knowledge of the subject and moulds it to suit the needs of the pupils.

A trained analytical mind, a good command of language and an effective delivery of the lesson help the teacher perform well on his side of the two-way communication network between him and his pupils. It is important that what is taught is assimilated, is thought-provoking, is capable of generating questions in the pupils and is presented in a vivid manner so that it is easily remembered.

To my mind, it is an amalgamation of all these components that leads to what may be termed 'purposeful teaching'.

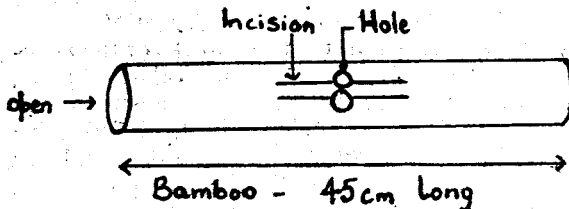
— A Well-wisher who reads 'PATHWAYS'.

Improvising Musical Instruments

Long before they can understand speech, or even speak themselves, children take pleasure in the rhythm and pattern of sounds around them. It is not uncommon to see them respond with an enthusiastic clapping of their hands to the beat of music that they hear. Naturally percussion instruments are among the most popular with little children, and schools often find that the addition of some of these to a music lesson greatly enhance the interest of the students.

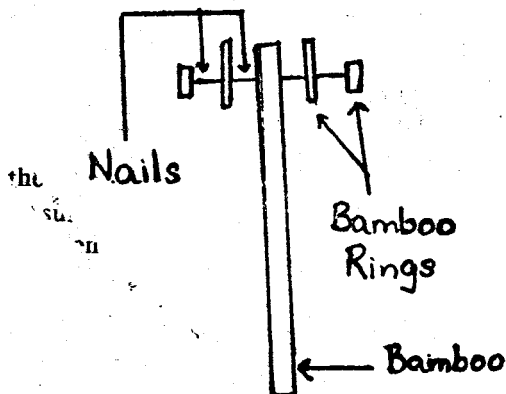
At a workshop for creative elementary music education held recently in Delhi, we were introduced to the art of making some musical instruments out of Bamboo, three of which I would like to share with readers.

The Log Drum :

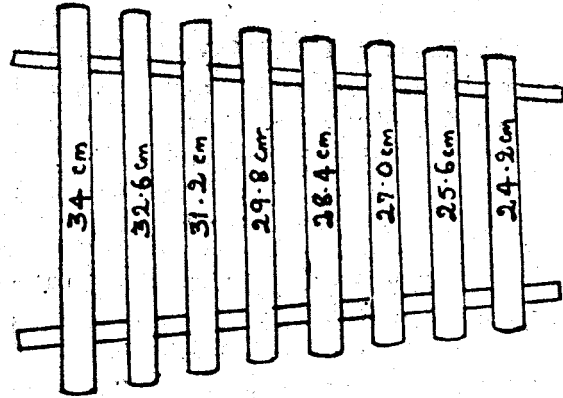


The closer the holes, the lower the frequency. The basic note is dependent on the quality of the bamboo itself.

A rattle can be made by nailing the bamboo rings left over from the making of the drum to a vertical support, as shown below:



The most exciting instrument that we learnt to make was a xylophone. Details are given in the diagram. Bamboo pieces slit in two are fixed to a wooden frame. Each is 1.4 cm shorter than the previous one.



To make neatly finished models one needs practice in the use of tools and perhaps the senior students in the wood-work class could be asked to help.

Yvette Menezes
Convent of Jesus and Mary,
New Delhi

वास्तविकता

पत्ते पेड़ से घुटने को आतुर
मृत्यु जीवन से घुटने को आतुर
प्राण बुढ़ापा छोड़ने को आतुर
बुढ़ापा जवानी छोड़ने को आतुर
काल मनुज को पीछे छोड़ने को आतुर
मनुज काल को पकड़ने को आतुर
मनुज तृष्णा की प्यास बुझाने को आतुर
तृष्णा मनुज की प्यास बढ़ाने को आतुर
रणवीर समर-विजय पाने को आतुर
और समर विजय रणवीर को थकाने को आतुर
विवश सूक कपोल शब्द बोलने को आतुर
शब्द सूक कपोलों के भीतर घुट मरने को आतुर
परिस्थितियां विवशता छोड़ने को आतुर
विवशता परिस्थितियों को जकड़ने को आतुर
एक धर्म दूसरे को ईश से जूझने को आतुर
और ईश समस्त धर्मों का समर देखने को आतुर
अतः समस्त ब्रह्माण्ड कुछ भी नहीं
अपनी दूसरे पर क्षेष्ठता जताने वाले
कुटिल व्यक्तित्वों का गठ बंधन है ।

— अमिताभ सिंह
Class XII (1980 Batch)
Sardar Patel Vidyalaya,
New Delhi

(contd. from page 3)

him, as well as other teachers, to be aware of these aspects of their profession and to constantly re-examine their own techniques and effectiveness.

Given below is a set of educational objectives, which you might like to categorise into the three domains.

- i. The student will be able to use the new words in the English lesson appropriately in his own sentences.
- ii. The student will be able to use the physical balance to measure masses up to an accuracy of 95 per cent.
- iii. The student will be able to understand the interdependence of living things.
- iv. The student will be able to collect information on the population of different countries from suitable sources and tabulate them.
- v. The student will be able to formulate hypotheses from a given set of facts.
- vi. The student will answer his teacher's questions with enthusiasm.
- vii. The student will be able to use the hockey stick to control the ball from one end of the ground to the other and back through the zig-zag path (between the poles) in three minutes.
- viii. The student will come regularly for football practice even though he has to walk home alone afterwards.
- xi. The student will submit assignments punctually.
- x. The student will be able to find grammatical mistakes in a given set of sentences.
- xi. The student will be able, after reading appropriate reference books, to write a factual account on the wild life of India.
- xii. The student will happily share his food with a friend who has not brought any food with him.



ROSES

A rose to me is not mere flower,
But a maiden bathed in a divine shower.
For, hidden in a veil of morning mist,
Is the softest face the sun's rays ever kissed
Slowly the innocent bud is unfurled,
Revealing a matchless beauty to the world.
Sharp thorns enshrine her heavenly heart,
And from evils and vices, keep her apart,
Adorned in a gay, flamboyant red,
Is a charming woman, tossing her head.
A woman in white, so pure and pretty,
With a mellow glow of serenity.
Yellows are the bright and noble ones,
Dazzling like a thousand suns.
The sweet, coy maiden, blushing pink,
Would melt a heart of stone, I think.
So gracefully and shyly she lives each day,
So gently and unconsciously she fades away.
Her silken petals are strewn on the earth when
she dies,
But her soul lives on immortally in Paradises.

Kamalini Ramdas
Age : 14 yrs.

There once was a teacher
Whose principal feature
Was hidden in quite an odd way.
Students by millions
Or possibly zillions
Surrounded him all of the day.

When finally seen
By his scholarly dean
And asked how he managed the deed.
He lifted three fingers
And said, "All you swingers
Need only to follow my lead."

To rise from a zero
To Big Campus Hero
To answer these questions you'll strive :

Where am I going,
How shall I get there, and
How will I know when I've arrived ?"

— Robert Mager

Biology - Learning Facts or Discovering the Wonder of Life ?

Mary Edna Mathews
St. Xavier's School, Delhi

With a view to making the learning of Life Science really exciting and not just diagrams, charts and a few unpronounceable words, I have been asking the seventh standard students to collect specimens relevant to their syllabus during the summer holidays. Their syllabus-mainly zoology-covers worms, insects, molluscs, birds etcetera. I make it clear to the students that I am more interested in observations, than in the number of specimens they have collected. During the first week or two after the school re-opens, biology periods are used to let the students exhibit their collections; share their observations and experiences while obtaining them with the others in the class.

It is amazing what minor details children observe about these animals. Sometimes their explanation for certain behaviours of the animals observed by them, though amusing, are very relevant. One boy made a day-by-day record of a pair of birds building their nest and hatching their young ones. Others watched the marvel of metamorphosis taking place in tadpoles (just the first stages). The shells collected by some at the sea-shore ceased to be pretty objects, becoming instead "the houses of living creatures". In their efforts to collect insects they come to know that cockroaches are nocturnal, while butterflies and bees are to be seen in the daytime.

Later in the year, as each phylum is being studied, I try to co-relate the knowledge they gained while making their collections with the lessons in the text-book.

I find that the best time to take the lesson on snails and earthworms is during the monsoon. Children are given the opportunity of collecting specimens from the school compound, observing them to find out facts about the habitat, the food habits. Other details are elicited by letting them answer specific questions on a work sheet.

(We asked Mrs. Mathews to let us have more details about the lesson on snails as many of you will be reading this during the monsoons. The material is given immediately after this article-Ed.)

Once a genuine interest has been created in the children, they will start referring to books in the Library and gather considerable extra knowledge on their own. All this extra work is rewarded by certificates or credits which are added to their test marks.

This may seem rather unconventional and impractical to some of you-but if you do try it out, I hope you will find it as rewarding and enjoyable as I have.

Phylum Mollusca -- The Snail

Students are divided into groups of four each and each group is given a small transparent glass plate, perhaps 10×15 cm. in size. Three areas of the school garden should be chosen and surveyed in advance. These are : a moist area with lush vegetation; a dry area with not many plants and the playground or similar area. Snails will be more abundant in the first of these as they feed on green leaves and cannot allow their moist skin to dry up. They are more often found on the under surface of leaves than on top, as this protects them from the hot sun and also from predators.

The leaves on which snails are found will very often be "eaten" at the edges or have holes on them. Caterpillars also have the same food habits and leaves on which caterpillars are found will have the same appearance. Grass hoppers, locusts and herbivorous animals also feed on leaves and harm the plant. Since the garden snail feeds on fresh leaves it is a foe of the farmer, specially the vegetable farmer. Some snails like the *Limnaea trunculata* act as the intermediate hosts in the life cycle of *Fasciola hepatica* (liver fluke). In certain parts of the world snails form a favorite article of diet.

The main part of the snail's foot is also its belly. It really moves on its belly. Naturally its speed is slow. You can observe from under the glass plate a wave of contractions pass through its foot when it moves. The shell is the snail's house. It carries its 'house' with it wherever it goes. The house is built by certain materials produced in the body of the snail and grows as snail grows. There is a circular door to the snail's house (shell) which can be tightly sealed by the snail as protection against heat and enemies. The snail can fit itself into its shell, since it has a soft body with no bones. It is an invertebrate. It uses its tentacles as feelers. It has got a pair of stalked eyes, but its eyesight is poor. The snail respires through lung-like pouches in its mantle or soft skin under the shell.

Some molluscs are useful to man. Shells of certain molluscs are used for making buttons and also as a source of lime. Pearls are obtained from oysters. The beautiful shells of molluscs are polished and used as ornamental objects. The flesh of clams, mussels, oysters, squid and octopus are edible.

Some molluscs are harmful. Snails and slugs eat leaves and damage plants. Shipworms feed on wood particles and cause great damage to wooden bridges, boats, ships. The octopus poses a grave danger to deep sea divers.

Let the students survey each of the chosen areas. They can then observe the snails moving on a glass plate. This helps in developing manipulative skills. Different groups will handle the snails differently. Muscular movements, blood vessels can be seen. Point out the slimy secretion given out by the snail, if the students have not yet noticed it. Let them touch different parts of the snail's body with a small twig or a pencil to observe how it responds to stimuli-watch it get back into its shell.

The teacher must help the students sum up their observations; show them other specimens belonging to the same phylum—the fresh water-mussel, oyster, octopus, squid, slug. Let them find out common characteristics of the phylum. This can be followed by a discussion on useful and harmful molluscs.

A sample of the Student's Worksheet is given below.

- Q. 1. a. In which area were the snails more abundant ?
b. What do you think was the reason for this ?
- Q. 2. a. Were the Snails found on the upper surface of the leaves or on the lower surface ?
b. Why were they there ?
c. What are the things a snail needs protection against ?
- Q. 3. a. What was the condition of the leaves on which the snails were found ?
b. Why are the leaves in that condition ?
c. What do you think is the food of the snail from observing the condition of the leaves ?
d. What other animals have the same food habits ?
e. Is the snail a friend or foe of man ?

Put a snail on a glass plate; raise the glass plate; watch how the snail moves on the glass plate, from beneath.

(Q. 1a stimulates observation while 1b helps students in finding the relationship between the environment and the animal. Q. 2a observation; 2b and 2c will help draw inferences from the observations made, Q. 3a and b will test understanding; 3c inference; 3d relationship between the snail and other animals.)

- Q. 4. a. What is the purpose of the slimy fluid secreted by the Snail ?

Observe the snail come out of its shell and get back into it. The snail can be gently pricked or prodded by a twig.

- Q. 5. a. What is the function of the shell ?
b. What is the function of the tentacles ? How many tentacles are there ? (Tentacles are the small projections on the head).
c. How is the snail able to get into such a small shell ?

Observe the nature and structure of the snail

(contd. on page 22)

Factorisation of Quadratic Polynomials

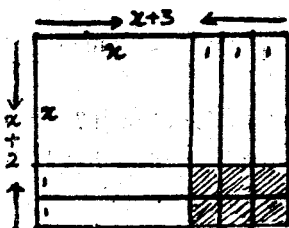
Saroja Sundararajan

The unit of area is the square unit. This arithmetical term can be linked geometrically with the above algebraic process. Using simple cardboard cut-outs I was able to help my students understand factorisation.

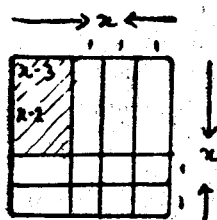
Materials required are cut out of stiff cardboard in the dimensions indicated below and painted or covered with glazed paper of the correct colour. For purposes of the lesson, a length of 5 inches is taken to be equivalent to 'x' units, and 1 inch as equivalent to 1 unit. We will need:

- * 20 pieces, $1'' \times 1''$ squares, painted red. Each of these will have an area of 1 sq. unit.
- * 15 pieces, $5'' \times 1''$ rectangles, painted yellow. Each of these will have an area of 5 sq. units or 'x' sq. units.
- * 4 pieces, $5'' \times 5''$ squares, painted green. Each of these will have an area of x^2 sq units.

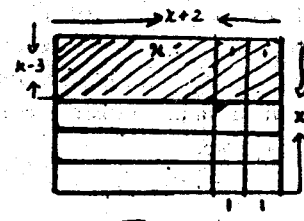
Any quadratic polynomial (that is factorisable over R) of the form $ax^2 + bx + c$ can be considered to represent the area of either a rectangle or a square, since the degree of the polynomial is 2 (or square).



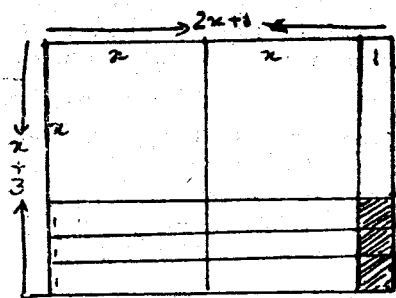
I a



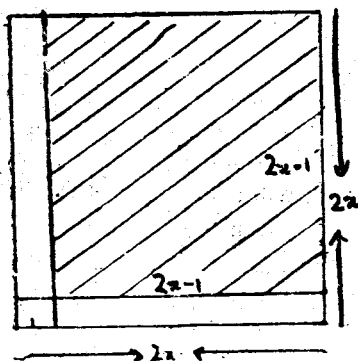
II a



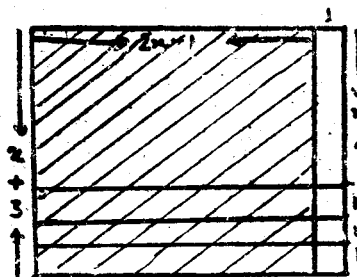
III a



I b



II b



III b

I. To factorise $x^2 + 5x + 6$ (when the signs in both factors are positive)

Give the students one big green square (x^2 sq. units), five yellow rectangles (five 'x' units) and six small red squares (six unit squares). Permit them to try various arrangements in order to form a proper rectangle. This can be done in more than one way. The dimensions of the sides of the rectangle which will represent this polynomial can then be easily figured out. Two examples are shown. Figure Ia shows the area of the rectangle $(x+2)(x+3) = x^2 + 5x + 6$. The shaded area represents the six unit squares which are added on to complete the rectangle. Figure Ib shows a rectangle where $(2x+1)(x+3) = 2x^2 + 7x + 3$.

II To factorise $x^2 - 5x + 6$ (when the signs in both factors are negative)

Now one green square, five yellow rectangles and six red squares are to be taken. Figure IIa shows how the cut-outs are arranged. As $5x$ is to be subtracted from x^2 , the yellow rectangles will be placed on top of the green square. Note that an area equal to six square units has been subtracted twice. To compensate, the six red unit squares may again be superimposed on this area so that, in effect, one subtraction has been cancelled out by an addition. The left-over area (shaded) is the one whose area represents the polynomial. Thus the factors of the given expression are $(x-3)(x-2)$; they are equal to the sides of the rectangle.

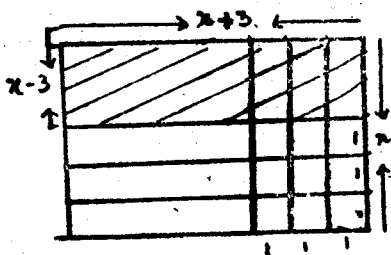
Figure IIb shows the factorisation of $4x^2 - 4x + 1$. The sides of the rectangle are equal to $(2x-1)(2x-1)$.

III To factorise $x^2 - x - 6$ (when one factor has a positive sign and the other a negative sign).

A little drill has to precede this example. The student needs to write down the coefficients of the first two terms of the polynomial, namely $+1, -1$ respectively. The product of the coefficient of the x^2 term and the constant will be $+1 \times -6 = -6$. This product has now to be split into its factors and a pair of those factors selected whose sum is equal to the coefficient of the middle 'x' term, namely -1 . We write down the possible factors of -6 . These are -6×1 ; -1×6 ; -3×2 ; -2×3 . Obviously only the sum of -3 and $+2$ will give us the required -1 .

The polynomial has now to be re-written as $x^2 - 3x + 2x - 6$. This implies that both $3x$ and 6 must be subtracted while $2x$ is to be added. The figure obtained is shown in IIIa. Note that the subtraction of the 6 units is carried out by placing six red squares over the vertical yellow rectangles. The remaining shaded portion has the dimensions $(x-3)$ and $(x+2)$ which are the factors of the polynomial.

Figure IIIb shows the arrangements for $2x^2 + 5x - 3$. The calculation is as follows. The product of $2 \times -3 = -6$. The factors suitable for our requirements are -1 and $+6$, whose sum is 5 , that is equal to the coefficient of the middle term. Thus the polynomial is re-written as $2x^2 + 6x - x - 3$. In the figure the cut-outs overlap in the unshaded area, which is therefore shows subtraction. The shaded rectangle represents the polynomial, and its sides $(2x-1)$ and $(x+3)$ represent the factors of the expression.



IV

To factorise expressions of the form of a difference of squares like $x^2 - 9$ is easier. Multiply the coefficient of x^2 by the constant factor and extract the square roots of the product, giving a positive sign to one and a negative sign to the other. Thus, $1 \times 9 = 9$; and $\sqrt{9} = \pm 3$. Thus the polynomial is re-written as $x^2 + 3x - 3x - 9$. In other words to an x^2 , we are to add a $3x$, subtract a $3x$ and subtract a 9 . The remaining shaded portion represents the polynomial as shown in figure IV.

Similarly $4x^2 - 9$ will become $4x^2 + 6x - 6x - 9$. This is because, $4 \times 9 = 36$; the $\sqrt{36} = \pm 6$. This is not shown in the diagrams.

After practising a few times, students find it easier to visualise the processes and can work directly in their notebooks.

(Mrs. Sundararajan has many years of experience as a teacher of Mathematics. She is currently Academic Supervisor at Springdales School, New Delhi and is one of the Wardens of their newly opened Teachers Centre.)

ELECTRIC CARD CIRCUITRY

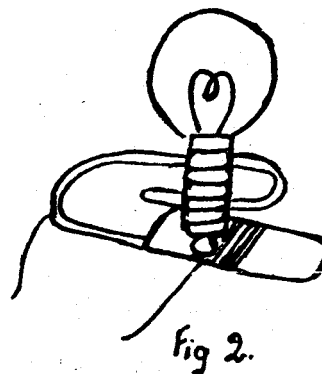
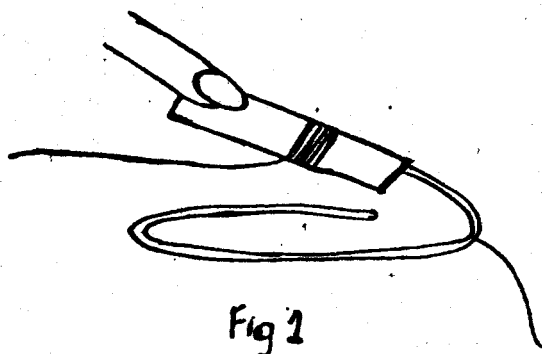
Meera A . Parasnis

Before making up a mini-electrical circuit, students must first make its various components-bulb holders, switches, cell+holders. These steps are outline below. I woud like to emphasise here that it is not enough merely to get the model working. Children must be encouraged to produce neatly finished work, good enough for being displayed in the classroom or at the School Annual Exhibition. In the process of carrying out these projects, the students not only see the principles of Science at work; they also develop manual dexterity and the ability to handle tools well. This is an important part of the exercise.

The material and illustrations of the article are given in such a manner that interested teachers may duplicate them and hand them to their students to start work without much explanation or help from the teacher.

Paper Clip Bulb-Holder and Switch

Materials : Large size paper clip, Electrician's tape (or cello tape), Connecting wires (as used in appliances at home), Flashlight bulb with screw type base, Flashlight battery.



Open out a large paper clip so that the two arms are at about 30° . Wrap a good length of tape around the small arm of the paper clip. Remove the insulation from about 10 cm of the end of a connection wire and wrap it three or four times around the tape. Twist the end of another piece of connection wire around the bare part of the paper clip. The paper clip bulb-holder (socket) is ready. Push a flash light bulb into the large arm of the paper clip so that the tip touches the wire around the tape. Adjust the arm so that the bulb fits tightly into it and makes good contact. Connect the free ends of the two wires to a dry cell. What do you see? The bulb lights up. Why?

The bulb-holder (without the bulb) (Fig 1) can also be used as a switch. The switch is closed when the small arm is depressed so that the wire around it touches the rest of the clip, and opened when released. Use paper clip bulb-holders and switches for making different electric circuits.

Make your own Cell-holder

Materials : Thick cardboard, Vaseline, Source of heat, Old tin, Shears (metal cutting scissors), Paper fasteners, Connection wires. Dry Cells, Thick paper, Cellotape.

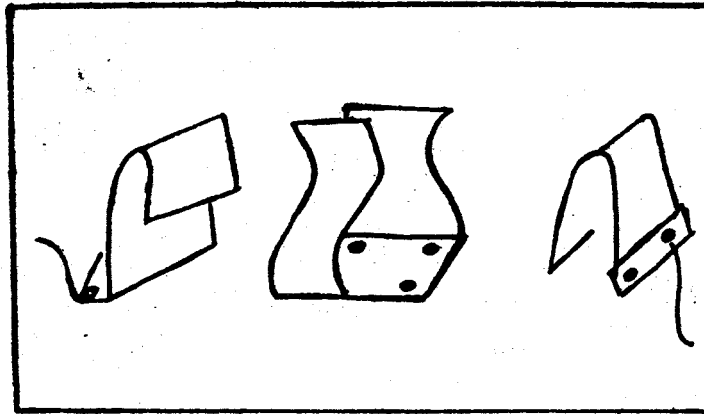


Fig. 3

Cut a piece of thick cardboard $20\text{ cm} \times 10\text{ cm}$. Apply a thin layer of vaseline to it. Move the cardboard over a heater for a few seconds. This hardens the cardboard and gives it a good finish. This cardboard will be the base of the cell-holder. From an old tin, cut two strips of metal $8\text{ cm} \times 4\text{ cm}$ each. Bend each piece at right angles at 2 cm from one end at 150° at 3 cm from the other end. The two bends should be in opposite directions. These two pieces will be called L-strappings.

Cut another strip $12\text{ cm} \times 4\text{ cm}$. Bend it to the shape of a dry cell. This is cell strapping. Use paper fasteners to fit the L-strappings symmetrically 13 cm apart along the long mid-line of the base. Fix the cell strapping in between the L-strappings. Connect wires to the L-strappings, one to each. The cell-holder is ready (Fig 3)

Wrap a thick piece of paper around two dry cells held 'head-to-tail' and tape it so as firmly to hold the cells in series. Place the cells in position in the cell-strapping. The free ends of the wires from the L-strappings are the two terminals of the two-cell battery. A slight adjustment of the L-strappings may be necessary to get good contact. You can similarly make a cell holder for a single cell or two cells in parallel.

Mini House-lighting Circuit

Materials : Enamelled or plastic covered wire, Cell holder, Paper clip sockets and switches. Flashlight bulbs made earlier.

Thick paper, Pair of scissors, Stapler, Cellotape, Dry Cell.

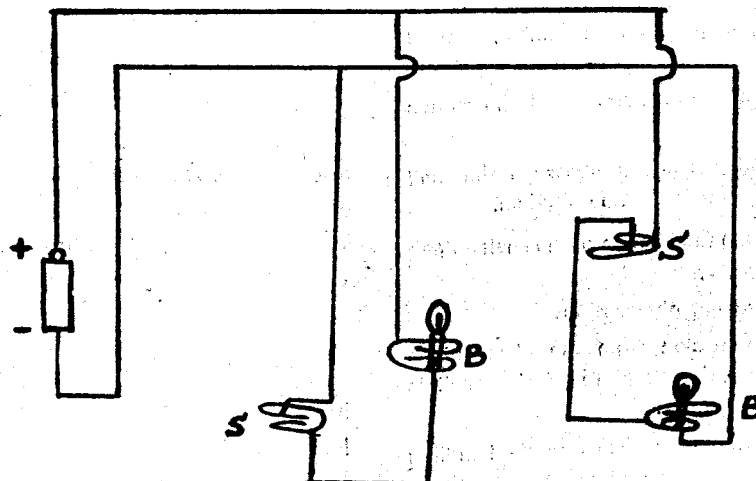


Fig. 4

(contd. from page 17)

- Q. 6. a. The earthworm about which you have already studied had a moist skin. The snail also has a moist skin. What common function does this moist skin perform ?
- b. Does the snail have bones and a skeletal system ?
- c. What are animals with no back bone called ?
- d. What other animals with shells have you come across ?

(Q. 4, 5 and 6 help the student to learn to manipulate the snail gently, without hurting it. Q. 5 helps the child to relate structure to function; Q. 6 relates previous knowledge to the present situation.)

Now sum up your observations and conclusions under the following headings :

1. Habitat of the snail
2. Food of the snail-how its food habits affect man.
3. The structure of the body of the snail and how it is suited to its environment.
4. Draw a neat diagram of the snail as you saw it and label the parts of its body.

(Would you like to think about the educational objectives which the teacher set for herself in the above lesson? We have listed them below. Would you care to comment on whether they are complete and achievable? —Editor.

The student will be able to :

- i) Describe a snail, its parts, its movement, its food habits and habitat.
- ii) Draw a diagram of the snail and label the various parts
- iii) Compare and find similarities between the snail and other members of the same phylum.
- iv) Appreciate how the food habits of the snail affect Man.
- v) Improve his powers of observation.
- vi) Draw simple conclusion from the observations recorded on how the structure of the snail is suited to its environment.
- vii) Improve his manipulative skills while handling snails.
- viii) Work in co-operation with a small group in performing this exercise.)

(contd. from page 21)

Cut out a rectangle 20 cm × 13 cm from thick card paper. Draw with a pencil an electric circuit showing on the card the pattern of wiring (Fig. 4). This is called a circuit diagram. Cut connection wires of suitable lengths. Remove insulation from wherever they are to make electrical contact. Lay the wires on the pencil drawing. Staple the wires, bulb sockets and switches in position one by one. Use cellotape wherever the stapler cannot reach.

Test the circuit by attaching a dry cell. Press each switch separately and check if the corresponding bulb lights up. Use two and then three switches at the same time. Every time check the lighting up of the bulbs. This is exactly how your home lighting works. You can switch on or off each light individually. Why? Prepare similar electric circuit cards for different circuit combinations.

□

Anthropologist Gregory Bateson tells the story of a little boy he knew who asked his father, "Do fathers always know more than their sons?"

"Yes," his father told him,

"Who invented the steam engine?" the son then wanted to know.

"James Watt."

"Well, why didn't James Watt's father invent it?"

× × ×

Our friend, an avant-garde artist, has covered every wall of her house with her paintings. An elderly friend came to visit her for the first time and was taken around the house. Indicating the weird shapes and colours on the walls, he told her sympathetically, "Children are the same everywhere."

× × ×

If, in instructing a child, you are vexed with him for want of adroitness, try to write with your left hand, and then remember that a child is all left hand.

— From The Reader's Digest, July 1980

TRACKS FOR LIVING

Not Just a Moral Science Series

but

A Vision of Life for Modern Youth

Units A, B, C, D for Classes IX, X, XI, XII.

Each Unit consists of a **Student's Personal Diary** and a **Teachers' Manual**, which provides the teacher with a set of detailed Lesson Plans. The material can be adapted to varying situations and types of students.

Excellent material for Camps, Orientation and Motivation Programmes and Meetings organised to train Youth.

- ★ **Experiential** : Starts from the student's own life.
- ★ **Participative** : Involves group participation, inter-action, discussion and sharing.
- ★ **Reflective** : Analysis helps the student to reach, in freedom, mature and responsible decisions.
- ★ **Prayerful** : This important aspect of the student's development is also incorporated into the programme. He seeks the help of the Supreme One in implementing his decision.

Prepared by a group of thirty-eight people of varied religious backgrounds, experienced in modern techniques, at the Leadership Training Service (L.T.S.) Value-Education Workshop, Calcutta, under the auspices of the Jesuit Educational Association (India).

SUPER PUBLISHERS

G - 2, 16 Ansari Road, Daryaganj,

New Delhi - 110 002.

M L S

Multilevel English Reading Programme

**A NEW INDIVIDUALISED TECHNIQUE FOR
LEARNING ENGLISH DEVELOPED FOR
THE FIRST TIME IN INDIA**

Based on

Dr. Don Parker's Multilevel Philosophy
of Self-paced Instruction.

Developed by :

Dr. Madhuri R. Shah

and

Kallolini P. Hazarat

The laboratory provides built-in flexibility which enables a teacher to use it for a specific class as per its need in his/her institution. It can be used where English is learnt as a *first* language in classes II to IV as well as where English is learnt as a *second* language, for the first three years of learning English. It can be used in the place of a text-book or as supplementary material.

The language lab is so devised as to cut down costs of instruction. The kit purchased by the school, can be shared among classes. All writing by the students is done only in the student Record Book. One lab can be used in a class of forty or more children.

COMPONENTS

1. POWER BUILDERS (100 DIVIDED INTO 10 DIFFERENT LEVELS)

- * to develop comprehension and vocabulary
- * assignments to develop skills in usage of words and structures

2. KEY CARDS (100 - ONE FOR EACH POWER BUILDER)

- * for self checking
- * for students to evaluate their own progress

3. STARTER BOOKLET (8 COPIES)

- * to assess student achievement level for placement

4. TEACHER'S HANDBOOK

- * to acquaint the teacher with the different skills the materials are designed to provide
- * to tell the teacher how to use the Reading Laboratory

5. STUDENT RECORD BOOK (ONE SAMPLE)

- * for students to record answers and plot charts of daily progress

DEMONSTRATIONS ARRANGED ON REQUEST

Published by

Multilevel Learning Systems

INDIA PUBLISHING HOUSE

25, Kamdar Chambers, Sion Bombay-400 022

Branch Office : 30-B, Prehlad Market,

(Karol Bagh) New Delhi-110005

Phone : 563282

Printed at : Adarsh Printers, Kotla Mubarakpur, New Delhi-110003. Phones : 624140, 693357
for The Educational Planning Group, 4, Raj Niwas Marg, Delhi-110054.